Dixline EMI/RFI Shielding (additional information)

EMI Shielding (Electro Magnetic Interference), RFI Shielding (Radio Frequency Interference), ESD Shielding (Electro Static Discharge), and Heat Shielding can all be achieved with the use of vacuum metalizing.

The advantages of vacuum metalizing are greater than many of the other common shielding processes like nickel acrylic, zinc arc spraying, or electroplating. Vacuum metalized EMI/RFI shielding cost less and is more environmentally friendly.

EMI/RFI Shielding using vacuum metalizing can be used for a wide variety of applications in industries such as wireless and telecommunications, electronics, medical, military, computers, test equipment and aerospace, with a good reputation for quality and service

EMI/RFI Shielding is typically accomplished by either Spray Coating with a conductive Paint or thin-film metallically coated with a physical vapor deposition (PVD) process.

Dixline uses only the advanced PVD method to provide EMI/RFI shield coating due to it overall superiority of uniformity, consistancy, control and costs. The brief descriptions below explain key differences between the processes.

1) Vacuum Metallization (PVD) Services
This coating procedure is a physical vapor deposition (PVD) process whereby plastic injection molded parts are masked and placed onto a rotating planetary cart within a vacuum chamber where the deposition takes place. The planetary cart has electrical buss bars with filament holders in which a predetermined load of pure aluminum or any other metal is placed. The chamber is then pumped down to approximately 2 x 10-5 torr. The aluminum is then heated to a vaporized state and is deposited in a line-of-sight trajectory onto the unmasked areas of the plastic parts. This process provides coatings of very high uniformity and batch-to-batch consistency. Typical thickness for functional thin-film EMI/RFI coatings is 2-3 microns and can be controlled to within +/- 0.2 microns. This process is currently the most advanced application method commonly used for shielding.

2) Spray Coating Services with Conductive Paints
This older traditional coating procedure is a spray-on process where the plastic injection molded parts are masked and then spray coated with nickel, copper, or silver filled paints utilizing high-volume, low-pressure (HVLP) spray gun equipment. Typical thickness for functional EMI/RFI coatings utilizing a nickel-filled paint is 2-3 mils, copper-filled paint is 1.5-2.5 mils, and silver-filled paint is 0.5-1.5 mils.

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Dixline EMI / RFI Shielding

Dixline EMI / RFI Shielding makes plastic enclosures impervious to electronic interference, protecting internal equipment. The shielding also protects external electronic devices from electrical interference caused by emissions from your device. Plastic enclosures coated with the Dixline PVD EMI Coating process is a cost-effective alternative to metal enclosures and other metalization processes. Some of the benefits of Dixline EMI Coating are:

- Outstanding Adhesion and Conductivity provides excellent EMI/RFI/ESD Shielding performance
- Thin metallic coatings do not alter part dimensions
- Cost-effective alternative to conventional shielding methods
- Repeatability of coating conductivity and thickness
- Precision masking provides consistent mask line control
- Thin film coatings will not interfere with product assembly
- Uniform coverage on complex substrates
- Coatings can be applied to most plastics
- None of the drawbacks of conductive paint

Dixline Corporation specializes in leading-edge vacuum sputter coating of highly conductive metal films for shielding. We routinely produce coatings with a resistivity rating of less than one ohm per square.

Dixline uses a high energy PVD process to deposit EMI Shielding Coatings on your surfaces. This process ensures excellent adhesion on all plastic surfaces with the thinnest of films. Typical thin film EMI / RFI shielding processes use a paint or low energy processes. This can cause poor adhesion and lead to flaking off of the coating, which leads to a breakdown in the shielding effects of the treatment. Dixline EMI Shielding Coating suffers none of these issues and is guaranteed not to flake or delaminate.

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EMI / RFI Shielding with PVD process

Shielding Effectiveness

Material	Thickness µm	Resistance mΩ	Shielding Efficiency dB	Freq
CU	1	17	75	100 MHz
			78	500 MHz
			81	1 GHz
CU	2	8.5	82	100 MHz
			85	500 MHz
			87	1 GHz
AL	2	27	77	100 MHz
			80	500 MHz
			83	1 GHz
AL	3.5	13.5	82	100 MHz
			85	500 MHz
			88	1 GHz

Evaluation of shielding efficiency

80 dB and higher	Very good to outstanding shielding efficiency
60 to 80 dB	Good to very good shielding efficiency
20 and 60 dB	Middle to good shielding efficiency
under 20 dB	Insufficient shielding efficiency

What is EMI / RFI shielding?

EMI / RFI stand for ElectroMagnetic Interference and Radio Frequency Interference (RFI is just EMI over the range of 1kHz - 10GHz). Electromagnetic radiation and radio frequency radiation are all around you! Their effects on the human body are the subject of fierce debate, but their effect on electronic devices is clear. They interfere. Sensitive components and circuits can be disrupted by interference from sources like power supplies, fluorescent lights, electric motors, switches and relays, even IC's. The clock in your computer oscillates and produces interference. In short, almost all electronic circuits develop some level of EMI and / or RFI. Shielding from EMI / RFI is done for two primary reasons: (1) to keep your electronic device from interfering with others, or (2) to keep other devices from interfering with yours. Often, regulatory agencies such as the U.S. Federal Communications Commission or the EU dictate standards for both emissivity of EMI / RFI and sensitivity to interference.

Dixline EMI/RFI Shielding (additional information)

Why use EMI / RFI shielding coatings?

The ideal enclosure for electromagnetic shielding would be a seamless sphere manufactured from highly conductive material, such as copper, aluminum, silver, or gold. Unfortunately, this solution is impractical and would render other functions of the enclosure useless. In the real world (the world of plastics), any enclosure designed in metal may be impractical and cost prohibitive. Often the cost constraints or even the shape required of an enclosure dictates use of plastic injection molded parts. Most plastic, however, is virtually transparent to EMI / RFI. For this reason, coatings have been developed to add shielding characteristics to plastic enclosures. These conductive coatings reflect the interfering radiation. Some common shielding coating materials are Silver, Copper, Nickel and Aluminum.

What are the properties of the different types of shielding coatings?

(All data herein represent typical values for various types of coatings.)

- **Silver:** The most conductive of commonly used coatings. Typically, silver's high cost prohibits its use in all but the most demanding circumstances. With the Dixline EMI/RFI Shield Coating process, silver cost the same as the other shielding materials. Silver has outstanding conductivity of 0.010 ohms/square/mil provide effective shielding up to 10 GHz at over 75 dB.
- **Aluminum:** The second most conductive of the common shielding coatings at 0.020 ohms/square/mil, provides up to 75 dB of protection up to 8 MHz.
- **Nickel:** Excellent durability due to the hardness of the nickel, along with low cost makes nickel a good choice if conductivity between that of copper and graphite is called-for. Conductivity is around 1 ohm/square/mil, which provides as much as 60-65 dB of protection at 2 mils over 5-1,800 MHz. Although not quite as good a conductor as copper or silver, it absorbs more electromagnetic interference on account of its magnetic permeability.
- **Copper:** Probably the most significant commercially used shielding coating material, many copper-based coatings use silver-plated copper fillers to improve resistance to oxidation of the copper. The conductivity of the copper shielding coatings is significantly greater than the previous two types: 0.075-0.10 ohms/square/mil.

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What are dB's and ohms/square/mil?

Since shielding coatings primarily reflect the offending radiation, you would think that it would be expressed as a percentage of radiation reflected, right? No, the measure of shielding effectiveness is expressed in decibels (dB), where:

dB = 10 log10 incident power density transmitted power density

Got that? If not, maybe it would help to express it as percentages:

20dB = 90% EMI blocked
40db = 99% EMI blocked
60dB = 99.9% EMI blocked
80dB = 99.99% EMI blocked

Our PVD coating systems can deposit any metal or alloy with fast lead times.
Whether your needs are aluminum, copper, nickel, stainless steel, alloys, super-alloys, or multilayer combinations Dixline Corporation can provide a solution tailored to your needs for the most demanding shielding projects, at a value that makes Dixline PVD Shielding the best in the industry.

- Mobile devices
- Automotive electronics
- Medical electronics
- Military hardware
- Avionics

[See Also Dixline EMI / RFI Shielding Data with PVD process] documentation